

EDITORIAL COMMENT

The Radial Artery Graft

Clinical or Subclinical Benefits?*



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In this issue of the *Journal*, Gaudino et al. (1) report on an interesting and fairly unique study describing the 20-year patency and outcomes in their initial series of 100 patients who received a radial artery (RA) graft, and who were prospectively followed. Previous long-term follow-up series of the RA as a coronary artery bypass graft (CABG) included those from Achouh et al. (2), Shi et al. (3), and the investigators of the Gaudino paper themselves (4). The main strength of the present study is the pre-specified systematic assessment of graft patency and RA harvest-related arm complications at specific time points, with a long period of follow-up.

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All studies that deal primarily with long-term graft patency have inherent weaknesses. Because it is virtually impossible to have all patients return for long-term invasive coronary anatomy and graft assessment, various methodological approaches may be used to estimate true conduit patency. Some authors choose to ignore, that is “censor,” patients who do not return for follow-up, both from the graft patency numerator (= number of grafts patent) and denominator (= total number of grafts). However, not returning for an angiogram because of death, disability, loss to follow-up, or simply an unwillingness to return is clearly informative; it is not a random event that has nothing to do with whether or not grafts are patent.

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In the paper by Gaudino et al. (1), the “20-year angiographic results” shown in Table 3 are obtained at 19 years from 33 of the 36 survivors, from an original cohort of 100 patients. This remains an oversimplistic assumption of true patency rates, considering by extension that if 100 patients had been followed and 99 died, 1 patient left showing patent grafts would constitute 100% patency.

Furthermore, despite increasing specificity and sensitivity with advancing technology, the role of the computed tomography angiogram for the evaluation of CABGs, especially arterial grafts, is not definitively established (5). Even the nonvisualization of a graft by gold standard invasive angiography is not an absolute guarantee that this graft is not patent, because selective injection may have been erroneous or prematurely abandoned. Perhaps more valid is the comparison with the internal thoracic artery (ITA) and saphenous vein (SV) in the present study, in the same “patient bioreactor.” Although the RA does not perform as well as the ITA, it is close, and is much better than an SV, which confirms what many presumed, but not all believed.

Patients in this study were operated on in 1993 and onward. Different levels of secondary prevention (6) and understanding of the RA, with regard to the importance of native stenosis and use of calcium-channel blockers, existed then. About one-half of the patients were not administered a calcium-channel blocker after surgery, whereas the other half received diltiazem. This being said, no general agreement currently exists as to whether calcium-channel blockers should be used after RA harvest for use in an aortocoronary position. Some surgeons, including the authors of this editorial, recommend using a daily dihydropyridine for 6 months, because diltiazem does not seem to have any pharmacological effect in vitro (7). However, it must be emphasized that randomized controlled evidence supporting

using a dihydropyridine for the RA as a CABG graft is lacking. A role may exist for labetalol in patients requiring a beta-blocker with vasodilator properties, albeit this also has not been formally studied clinically (8).

The next big question is: does the use of the RA, rather than a vein, decrease major adverse cardiovascular and cerebrovascular events and mortality, and is it as good as the bilateral ITAs? Unfortunately, despite the quality of the present paper, both dilemmas still cannot be answered with a high level of evidence. Although a plethora of observational studies suggest that bilateral ITA use, and the use of an RA as a second or third arterial graft, at CABG are associated with improved freedom from death and major adverse cardiac event compared with the use of a single ITA graft + SV, using a second or third arterial graft is so intimately linked to a given patient's likelihood of long-term survival that no amount of post hoc statistical analysis will ever completely eliminate such indication bias. Only a few randomized controlled trials addressing this clinical benefit question exist. RAPS (Radial Artery Patency Study), which enrolled 510 patients at 9 Canadian centers with within-patient randomization, reports the longest-term data. In RAPS, the RA was randomized to either the right or circumflex territory, and an SV was grafted on the other territory. At 5 years, the frequency of functional graft occlusion was 12% in RAs, compared with 20% in SVs. Despite the within-patient randomization design, late major adverse cardiac events were blindly assessed and more commonly attributed to the SV over the RA (9). Another randomized study of RA versus SV was performed at 11 Veterans Affairs medical centers among 757 participants undergoing first-time elective CABG, in whom there was no significant difference in study graft patency at 1 year (89% in both groups), and no significant differences in clinical endpoints (10); unfortunately, this study has no published follow-up as of yet. Finally, the RAPCO (Radial Artery Patency and Clinical Outcomes) trial is an Australian double-armed randomized controlled trial comparing the RA with the free right ITA in a younger cohort of patients undergoing elective CABG, and the RA with the SV in an older group. Midtrial results have shown equivalent survival, event-free survival, and graft

patency in both arms at a median follow-up of approximately 6 years, and the final trial results are pending (11). Thus far, comparable results of the RA and right ITA with regard to patency and impact on survival make the former a reasonable alternative to the latter, especially in patients at higher risk for sternal wound infection (12).

It is reassuring to know that RA harvest does not seem to come at a price to the operated arm, as confirmed in this article. However, it must be emphasized that most RA harvests are usually performed on the nondominant arm after appropriate pre-operative selection, and that extreme sensory and motor performance after RA harvest, such as that of the left hand of a right-handed concert violinist, has never been addressed. For most mortals, however, performing RA harvest for use at CABG on a target artery with a high degree of stenosis seems like a fair deal (*"pari raisonnable"*), because it does not increase infections like the right ITA, has aortocoronary versatility, and provides easy surgical handling akin to that of an SV, with possible clinical advantages in patients whose survival is anticipated to be long term. Notably, a general consensus, supported by published reports, indicates that a RA should not be used after having been cannulated for coronary angiography.

Endoscopic RA harvest was not evaluated in this series. Long-term data are now available from select centers suggesting equivalent RA graft patency at 5 years (at more than 87%) between conventional and endoscopic RA harvest. The latter therefore likely constitutes a reasonable approach in select centers that are proficient at this technique (13).

The investigators, therefore, are to be commended for establishing such a rigorous follow-up protocol to evaluate the validity of RA grafting when they adopted this technique 20 years ago. The study adds to the evidence suggesting that the RA may subclinically represent the second-best conduit for CABG after the ITA, albeit of still unproven incremental clinical benefit over the use of SV.

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